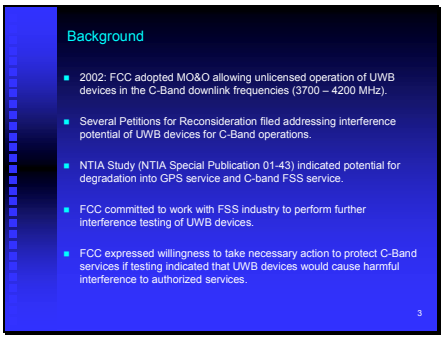
Slide 1

Slide 2

Slide 3



Slide 4

C-Band Coalition Technical Assessment

- C-Band Coalition goal: determine ways that UWB and other unlicensed devices can share spectrum and successfully coexist with C-Band satellite services.
- C-band Coalition commissioned ALION Science and Technology to model, validate, simulate, quantify, and demonstrate potential effects of UWB and lower adjacent band unlicensed devices on C-Band earth station receivers.
- Alion Science and Technology
  - World-Recognized Analysis Facility and Laboratory
  - Specialists in Spectrum Compatibility
  - Many Government and Commercial Projects

4

Slide 5

The Alion Study -- Testing Methodology

- Computer Modeling and Simulation
  - typical C-Band deployment
  - currently-approved (Part-15) UWB power levels
- Laboratory Testing to verify and validate the model and performance
  - C-Band transmissions
  - UWB signal source
- Test parameters more robust than prior studies and chosen to approximate real-world conditions

5

Slide 6

Alion Test Parameters for UWB Devices

A. Modeled with isotropic antennas
B. Modeled to simulate network traffic using random factor to simulate devices transmitting, devices receiving
C. Power levels did not exceed FCC-permitted levels; random factor simulated UWB devices' propagation in relation to C-Band receiver
D. Propagation was modeled by simulating free space, foliage attenuation, and building attenuation
E. Devices varied with randomized factor in X, Y, and Z location distributions around C-Band receiver
   - 30 meter exclusion zone
   - random heights above ground representing single family homes, apartments, and office buildings
   - no transmissions in receive antenna main beam
F. Devices had pulse repetition frequency similar to information-carrying modulation

6

Slide 7

Alion Test Parameters for C-Band Receivers

A. Earth station elevation angles varied from 5° to 15°

B. Link budgets used necessary 3 dB margin above freeze frame threshold; maintained constant noise temperature at low elevation angles

C. Typical modulation
- Analog FM-TV
- Digital QPSK, 8PSK

7

Slide 8

Laboratory Testing

- Perform validation of receiver models versus selected UWB and lower adjacent band interfering signals.
- Vary C-band receive signal parameters and interfering signal parameters to determine point where the picture ceased to be usable (e.g., freeze frame or black screen for digital video service).
- UWB signal source: Multispectral Solutions Model TFP1001
  - dithered and undithered

8

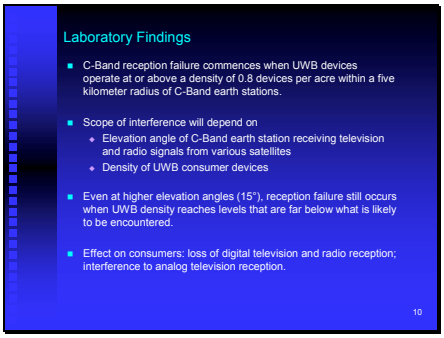
Slide 9

Modeling and Simulation Results

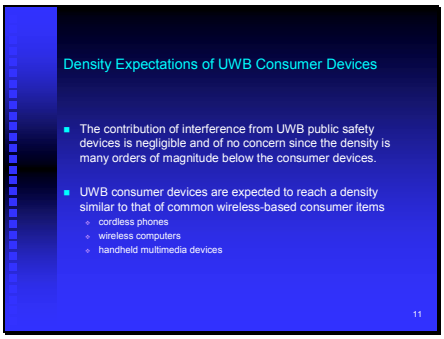
- Analog and Digital signals are vulnerable to UWB interference.
- 8PSK, which is necessary for HDTV and only about 2 dB more sensitive than QPSK, will be most affected by UWB.
- UWB interference will be a function of the density of devices.

9

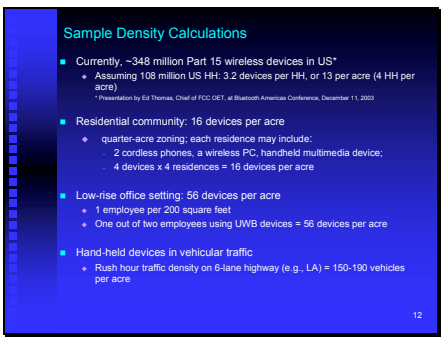
Slide 10



Slide 11



Slide 12



Slide 13

Precedent for anticipation of rapid growth in density of UWB consumer devices

- PCs in US HH grew from 42% to 51% (1998 – 2000)
- US HH with internet access grew from 26.2% to 41.5% (1998 – 2000)
- Cordless telephones grew from 11% to 81% of US HH (1985 – 2002)
- Cellular telephones grew from 0.1% to 56% of US HH (1985 – 2002)
- Cellular telephone subscribers grew from 11M to over 140M (1992 – 2002)
- Population in major metropolitan areas (1-5 million) grew by 19% during 1990s
- Typical urban population and housing densities indicate a potential market for household UWB applications far above the critical level indicated by analyses

13

source: ALION study, page 6-2

Slide 14

Elevation Angles and Population Densities were analyzed for six C-Band satellites

- AMC-8 at 139º W.L.
- AMC-7 at 137º W.L.
- SATCOM C-4 ([AMC-10]) at 135º W.L.
- Galaxy IR ([Galaxy XV]) at 133º W.L.
- Galaxy XI at 91º W.L.
- AMC-3 at 87º W.L.

- Satellites at these orbital locations provide large quantity of television and radio distribution.
- FCC assigned satellites to 131°-139° to provide video services to all 50 states.
- Certain portions of the orbital arc are fully-occupied programming neighborhoods.
- Program networks and affiliates have upwards of 100,000 C-Band antennas pointed at these locations.
- Many program networks have long-term commitments (10-15 years) to satellite operators to continue network transmission from these locations.

14

Slide 15

Examples of television programming carried on these satellites

ABC Radio
Alaska One TV
AMC
Animal Planet
BET (multi-channel)
Black Stars' West
Bloomberg Television
Bravo
Cartoon Network
CBS Radio
Christian TV NW
Cinemax (multi-channel)
Classic Arts Showcase
CMT
CNBC
CNN
CNN Airport
CNN en Espanol
CNNi
CNN Headline News
CNNfn
Comedy Central
Comcast SportNet MidAtlantic
C-SPAN
Discovery Channel
Discovery HD
Discovery Health
Disney Channel
DIY Channel
Encore (multi-channel)
ESPN
ESPN2
EWTN
Flix
Focus on the Family Radio Network
Food Network
Fox Network
Fox News Channel
Fox Sports Net
Fox Sports World Espanol
FX Network
Galavision
Game Show Network
HBO (multi-channel)
HTS
Home & Garden Channel
Home Shopping Network
In Demand
Independent Film Channel
International Channel
Infinity Radio
InfoRadioNet
KAKM-TV
KCAW-FM
KCNC-TV
KDVR-TV
KMOJ-TV
KMGH-TV
KSKA-FM
KTBY-TV
KTUU-TV
KTOO-FM
KTLA-TV
KTVA-TV
KUAC-FM
KUSA-TV
KYES-TV
Michigan Government TV
Moody Bible Radio
MSNBC
MTV
Nickelodeon
Nostalgia
Oxygen
QVC
Salem Radio Network
Sci Fi Channel
Shop at Home Network
Showtime
Spike
Starz! (multi-channel)
The Golf Channel
The Learning Channel
The Inspiration Network
The Movie Channel
The Weather Channel
TNN
TNT
Travel Channel
Tri State Christian TV
Turner Classic Movies
TV Guide
Univision
VH1 East
WAM!
WB Network
We
Westwood One
WPIX-TV
WSBK-TV
YES Network

15

Slide 16

Alion Study demonstrates destructive interference to C-Band television and radio reception

- When UWB consumer device densities reach 0.8 per acre, destructive interference will occur to television and radio program services at low elevation angles (5°)
  - Northeast
  - Alaska
  - Hawaii
- Even at higher elevation angles, television and radio reception failure will occur at UWB densities far below the projected densities
  - Boston (approximately 7.5°-12.5°)
  - New York (approximately 10°-15°)

16

Slide 17

[Insert Evans' maps (3 slides: AK, HI, N.E.)]

17

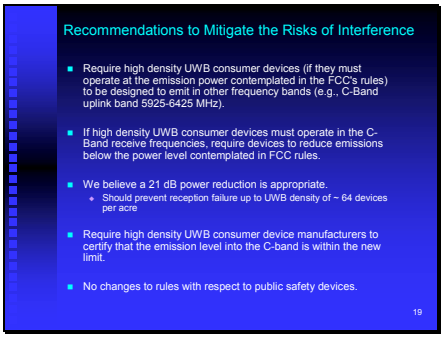
Slide 18

Summary

- Distribution and density of UWB consumer devices will determine impact of interference on C-Band television and radio program reception.
  - It is difficult to predict or control the adoption rate of new UWB consumer devices, but history suggests a ubiquitous deployment in a short period of time
- The C-Band Coalition is concerned about the likelihood of new UWB consumer devices causing significant interference to television and radio program reception.
  - C-Band is the predominant means of television and radio satellite distribution
  - C-Band industry is heavily invested with long-term commitments by program networks and MVPDs
- If precautions are not taken now to minimize the risks of interference
  - television and radio service could be severely disrupted
  - the C-Band industry will encounter insurmountable difficulty and expense trying to remedy the problems

18

Slide 19



Slide 20